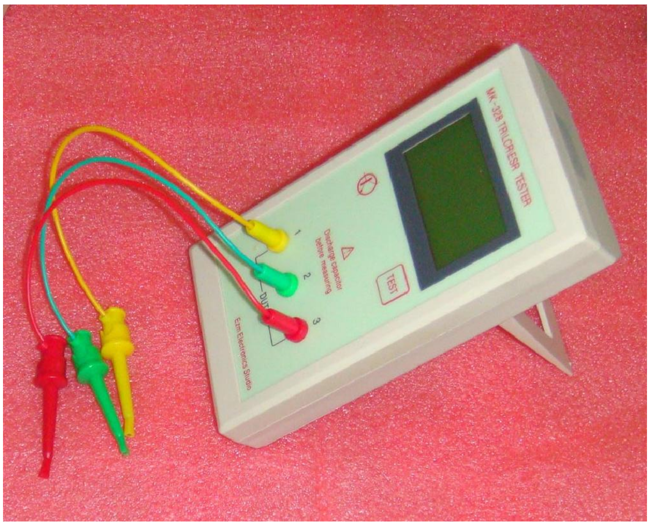
MK-328 TR\LCR\ESR

Transistor \LCR\ESR Tester User Guide



EZM ELECTRONICS STUDIO

1.troduction

This meter is an intelligent semiconductor device analyzer, it can measure most of the diodes, bipolar transistors, Junction/MOS FETs and low power thyristors. It automatically identifies the type of devices and pinouts, measures the current gain HFE, gate theshhold and FET junction capacitance, a typical application is to pair two transistors or identify an unknown SMD device. The test clips can be connected any way round, the pinout can be identified and displayed on screen vs. test clip numbers. Beside the semiconductor device analyzer, this meter can also work as a RLC/ESR meter, the RLC/ESR accuracy may not be able to compete with the professional one, but it definitely meets the needs for most of the applications. A 9V battery (part number 6F22) is used for this meter, the typical working current is about 20mA, standby current is about 20nA. Dimension: 83x152x34mm, weight 175 gram (no exclude battery).

Special caution: Discharge the capacitors completely before you measure it, otherwise, it could damage your meter!

2. Panel features, test clips and test jig

2.1 Panel features (refer to Figure 1)

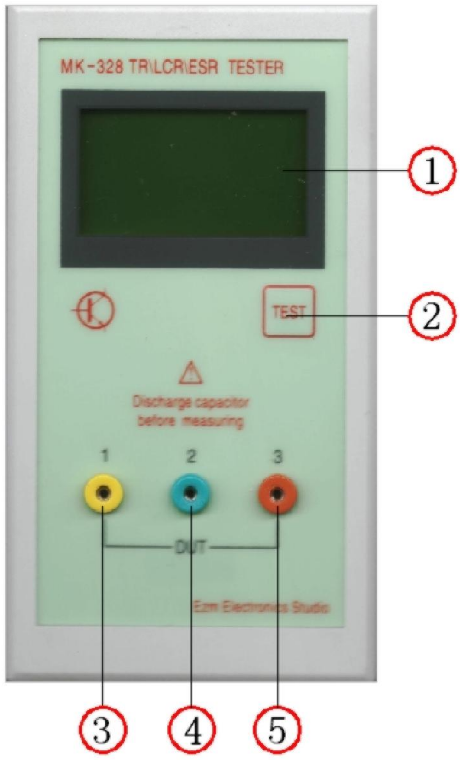


Figure 1: Panel features

① :LCD screen, to display measured data

② : Test/power-on button. When this button is first pushed, it turns on the meter power and excuses a measurement. After that, every push, it will excuses a measurement. The meter will turn

off the power automatically if you don't use it within 20 seconds

③ : Test terminal 1, Yellow, will display as pin 1 on LCD.

④ : Test terminal 2, Green, will display as pin 2 on LCD.

⑤ : Test terminal 3, Red, will display as pin 3 on LCD.

2.2 Test clips and test jig

For those big size DUTs (device under test), you may connect them directly to the test terminals, otherwise, you need the test clips and test jig as shown in Figure 2 and Figure 3. With clips and jig you can measure all most all the devices.

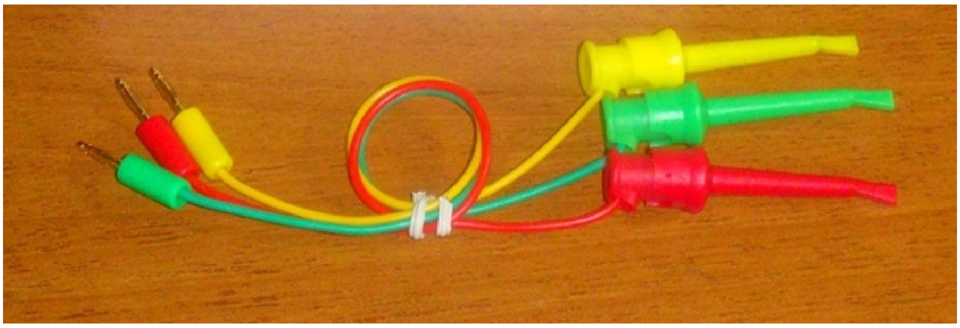


Figure 2: Test clips （standard）

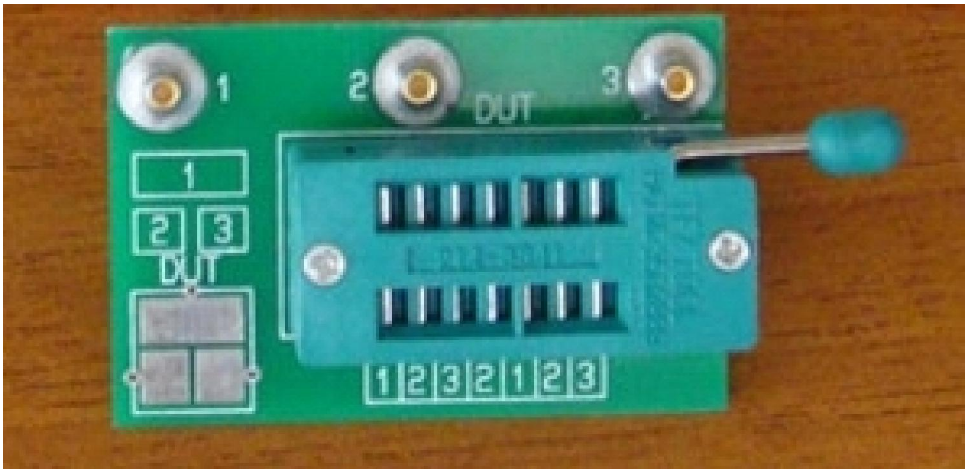


Figure 3: Multi-function Test Jig(option)

3. Basic Meter operation

3.1 Clips: Three clips can be used for any non-SMD devices, you can hook up the clips any way round, the meter will identify and display the pinout vs. the clip numbers on the screen. Figure 4 shows an example for a medium-power NPN transistor test.

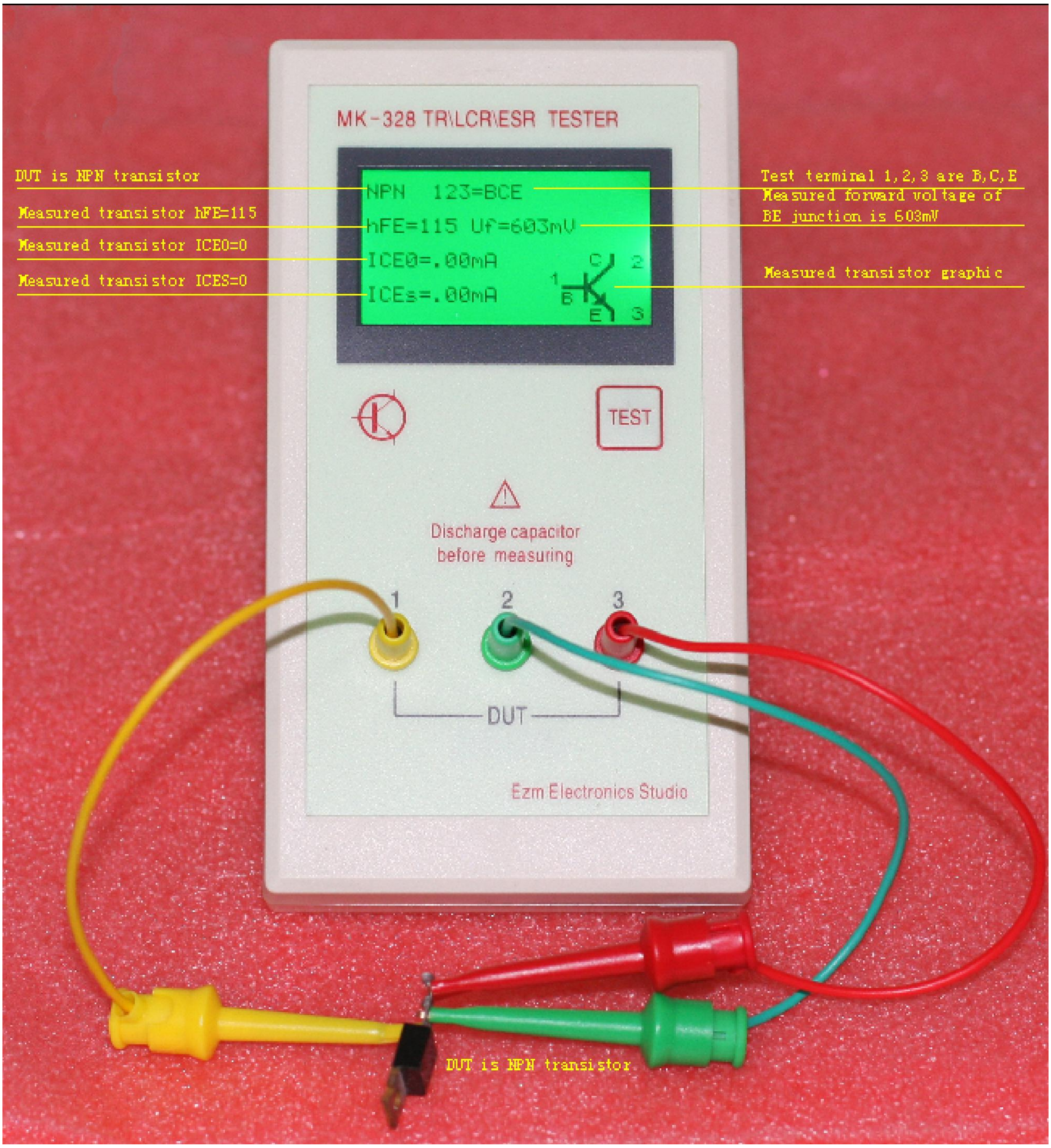


Figure 4: Test Transistor with Test Clips

3.2 Test Jig: It is used for small pin pitch and thin pin lead device, such as low power transistor, resistor and capacitors,.This jig has a test area for SMD devices. Figure 5 shows an example of capacitor test .

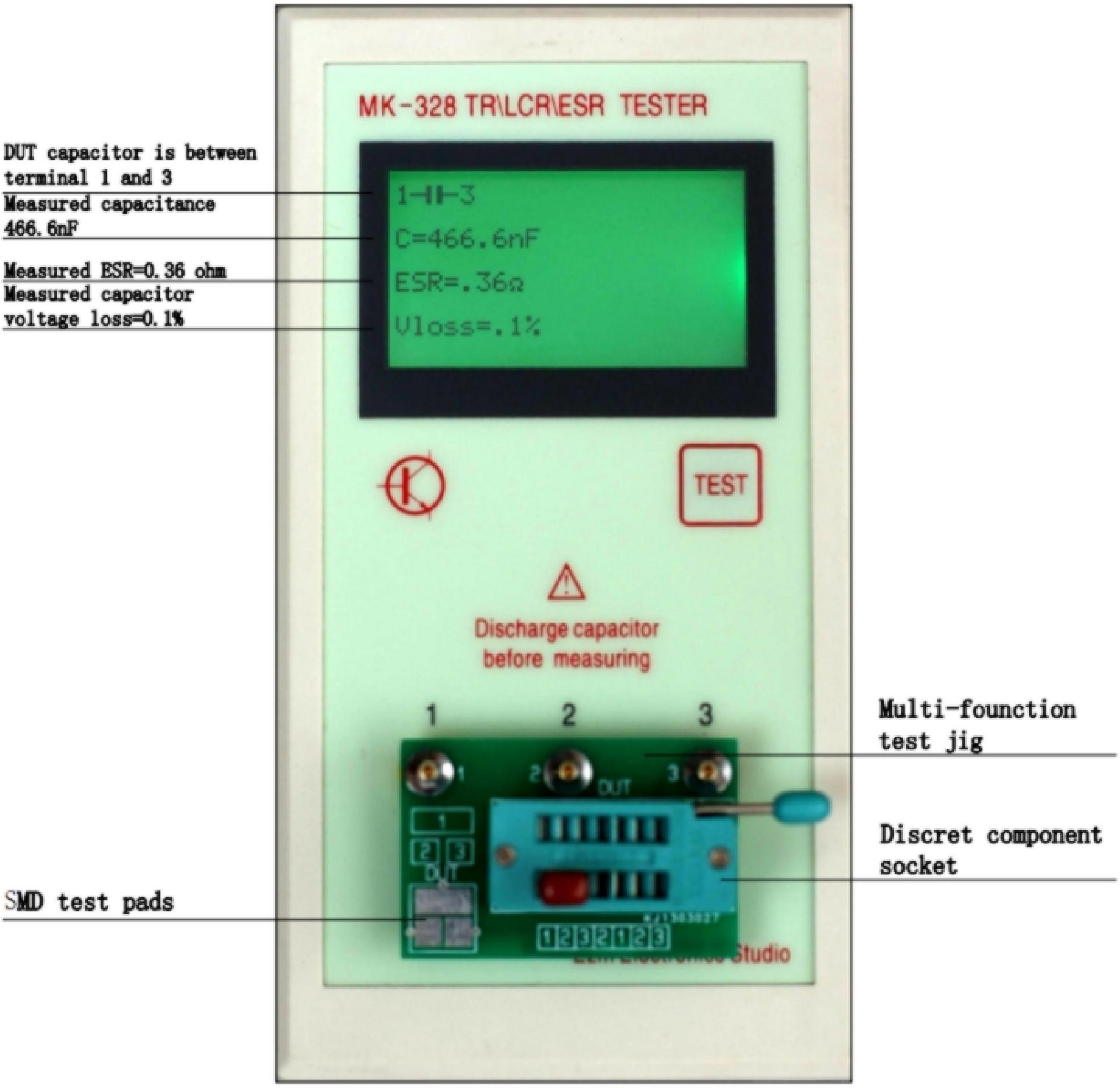
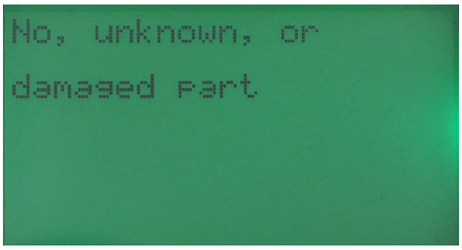


Figure 5: Test Capacitor with Test Jig

4. Test examples

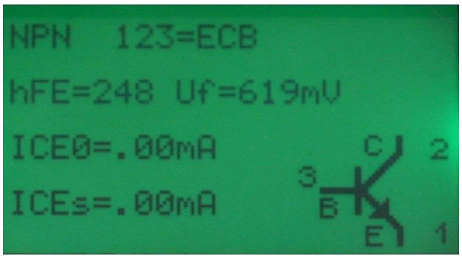
4.1



It shows that no device is connected on test terminals or an unknown part. It may also be that the devise was damaged

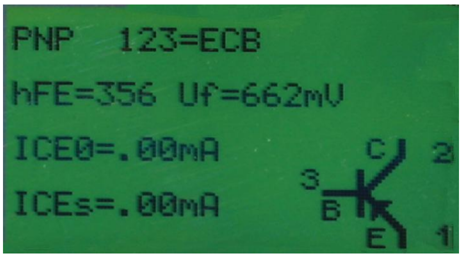
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4.2 Test a NPN transistor



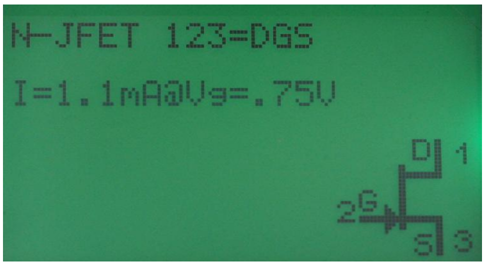
It shows that the DUT is NPN transistor, test terminal 1,2,and 3 are connected to E,C and B pins, Gain is 248, and forward voltage on junction B and E is 619Mv, leakage current ICE0=0,ICES=0.

4.3 Test a PNP transistor



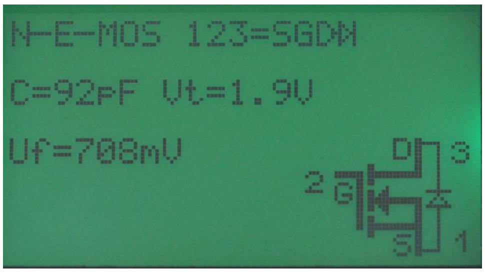
It shows that the DUT is a PNP transistor, the test terminals 1, 2 and 3 are connected to transistor pin E, C and B, Gain is 356, the forward voltage on B and E junction is 662mV, leakage current ICE0=0,ICES=0.

4.4 Test a Junction FET



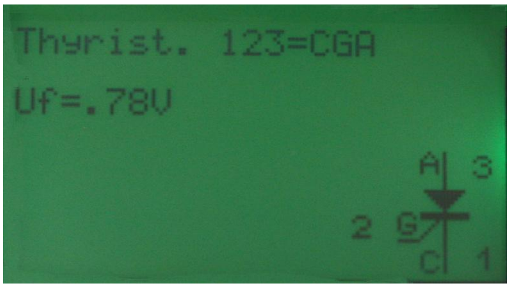
It shows that the DUT is a N junction FET, the test terminals 1, 2 and 3 are connected to pin D, G and S. When the voltage between G and S is 0.75V, the measured drain current is 1.1mA

4.5 Test a MOS FET



It shows that the DUT is NMOS FET, test terminals 1, 2 and 3 are connected to pin S, G and D. There is a protect diode between S and D, the anode of the diode is connected to S, and the cathode of the diode is connected to D.Junction capacitance is 92pF, the gate threshold voltage is 1.9V and the forward voltage is 708mV.

4.6 Test a thyristor



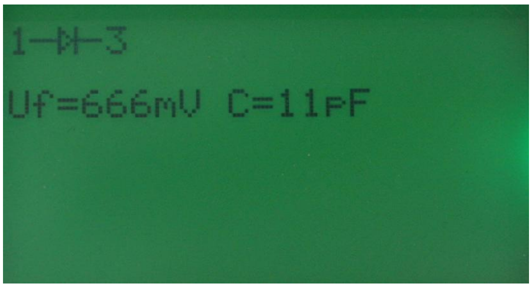
It shows that DUT is a thyristor, test terminals 1, 2 and 3 are connected to pin C (cathode), G (control gate) and A (anode), the forward voltage is 0.78V.

4.7 Test a triac



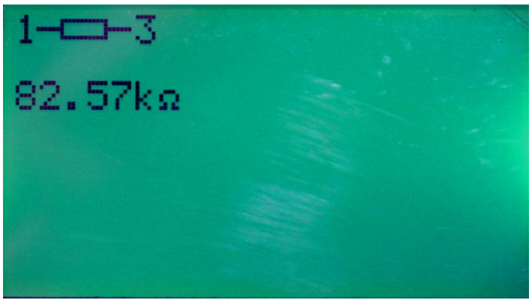
It shows that the DUT is a triac, test terminals 1, 2 and 3 are connected to first anode 1, control gate G, second anode2, and the forward voltage is 0.99V

4.8 Test a diode



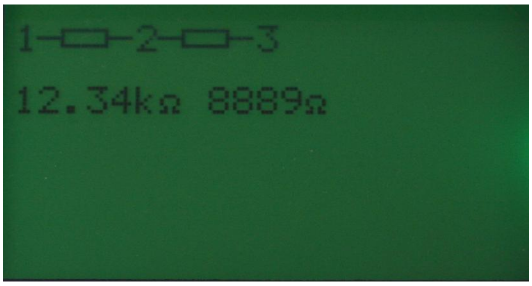
It shows that the DUT is a diode, test terminal 1 is connected to anode, and test terminal 3 is connected to cathode. The forward voltage is 666mV. Junction capacitance is 11pF.

4.9 Test a resistor



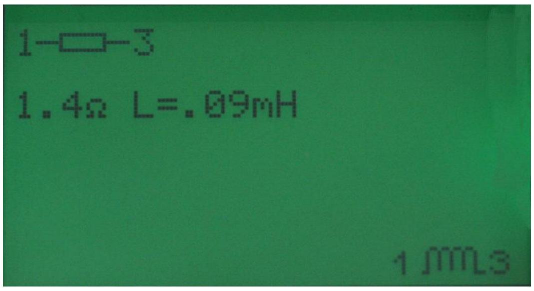
It show the DUT is a 82.57k resistor, between terminal 1 and 3.

4.10 Test two resistors



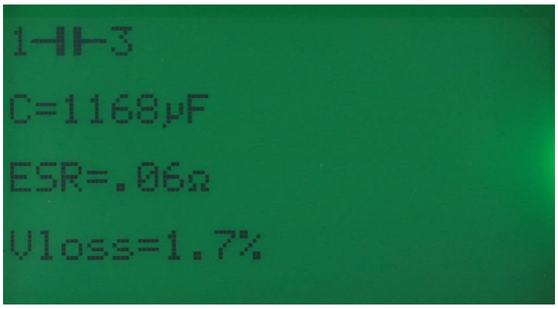
It shows that the DUT are two resistors, 12.34k ohm between terminal 1 and 2, and 8889 ohm between terminal 2 and 3.

4.11 Test an inductor



It shows that the DUT between terminal 1 and 3 is an inductor, L=0.09mH, and DC resistance is 1.4ohm

4.12 Test a capacitor



It shows that the DUT between terminal 1 and 3 is a capacitor. Capacitance =1168uF, ESR=0.06 ohm and Voltage loss is 1.7%.

5. Inseting battery

5.1 Remove the battery compartment cover.

5.2 insert a 9V 6F22 battery.

5.3 Replace the compartment cover.



Figure 6: Battery compartment

6.Features

6.1 Operates with ATmega328 microcontrollers.

6.2 Displaying the results to a 128x64 graphic LCD-Display.

6.3 One key operation with automatic power shutdown.

6.4 Shutdown current is only about 20nA.

6.5 Automatic detection of NPN and PNP bipolar transistors, N- and P-Channel MOSFETs, JFETs, diodes, double diodes, Thyristors and Triacs.

6.6 Automatic detection of pin layout of the detected part.

6.7 Measuring of current amplification factor and Base-Emitter threshold voltage of bipolar transistors.

6.8 Darlington transistors can be identified by the threshold voltage and high current amplification factor.

6.9 Detection of the protection diode of bipolar transistors and MOSFETs.

6.10 Measuring of the Gate threshold voltage and Gate capacity value of MOSFETs.

6.11 Up to two Resistors are measured and shown with symbols and values with up to four decimal digits in the right dimension. All symbols are surrounded by the probe numbers of the Tester (1-3). So Potentiometer can also be measured. If the Potentiometer is adjusted to one of its ends, the Tester cannot di er the middle pin and the end pin.

6.12 Resolution of resistor measurement is now up to 0.01Ω, values up to 50MΩ are detected.

6.13 One capacitor can be detected and measured. It is shown with symbol and value with up to four decimal digits in the right dimension. The value can be from 25pF to 100mF. The resolution can be up to 1pF .

6.14 For capacitors with a capacity value above 0.18µF the Equivalent Serial Resistance (ESR) is measured with a resolution of 0.01Ω and is shown with two significant decimal digits.

6.15 For capacitors with a capacity value above 5000pF the voltage loss after a load pulse can be determined. The voltage loss give a hint for the quality factor of the capacitor.

6.16 Up to two diodes are shown with symbol or symbol in correct order. Additionally the flux voltages are shown.

6.17 LED is detected as diode, the flux voltage is much higher than normal. Two-in-one LEDs are also detected as two diodes.

6.18 Zener-Diodes can be detected, if reverse break down Voltage is below 4.5V. These are shown as two diodes, you can identify this part only by the voltages. The outer probe numbers, which surround the diode symbols, are identical in this case. You can identify the real Anode of the diode only by the one with break down (threshold) Voltage nearby 700mV!

6.19 If more than 3 diode type parts are detected, the number of founded diodes is shown additionally to the fail message. This can only happen, if Diodes are attached to all three probes and at least one is a Z-Diode. In this case you should only connect two probes and start measurement again, one after the other.

6.20 Measurement of the capacity value of a single diode in reverse direction. Bipolar Transistors can also be analysed, if you connect the Base and only one of Collector or Emitter.

6.21 Only one measurement is needed to find out the connections of a bridge rectifier.

6.22 Capacitors with value below 25pF are usually not detectet, but can be measured together with a parallel diode or a parallel capacitor with at least 25pF. In this case you must subtract the capacity value of the parallel connected part.

6.23 For resistors below 2100Ω also the measurement of inductance will be done, if your ATmega has at least 16K flash memory. The range will be from about 0.01mH to more than 20H, but the accuracy is not good. The measurement result is only shown with a single component connected.

6.24 Testing time is about two seconds, only capacity or inductance measurement can cause longer period.

6.25 Software can be configured to enable series of measurements before power will be shut down.

6.26 Selectable facility to calibrate the internal port resistance of port output and the zero o set of capacity measurement with the selftest . A external capacitor with a value between 100nF and 20µF connected to pin 1 and pin 3 is necessary to compensate the o set voltage of the analog comparator. This can reduce measurement errors of capacitors of up to 40µF. With the same capacitor a correction voltage to the internal reference voltage is found to adjust the gain for ADC measuring with the internal reference.

6.27 Display the Collector cuto   current ICE0 with currentless base (10μA units) and Collector residual current ICES with base hold to emitter level . This values are only shown, if they are not zero (especially for Germanium transistors).

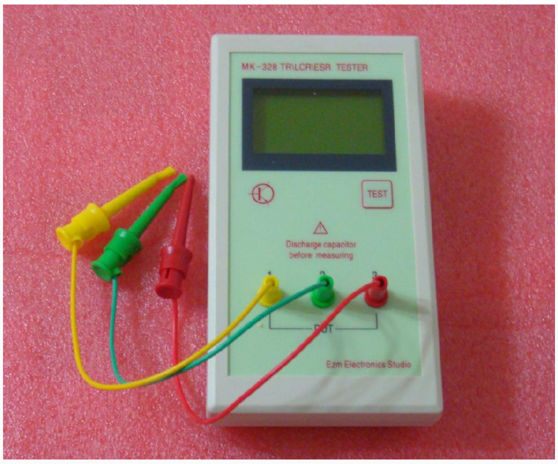
6.28 Thyristors and Triacs can only be detected, if the test current is above the holding current. Some Thyristors and Triacs need as higher gate trigger current, than this Tester can deliver. The available testing current is only about 6mA!

Attention: Allways be shure to discharge capacitors before connecting them to the Tester! The Tester may be damaged before you have switched it on. There is only a little protection at the ATmega ports.

Extra causion is required if you try to test components mounted in a circuit. In either case the equipment should be disconnected from power source and you should be shure, that no residual voltage remains in the equipment.

7. Product configuration

7.1 standard configuration (As show in figure)



7.2 Option (As show in figure)

